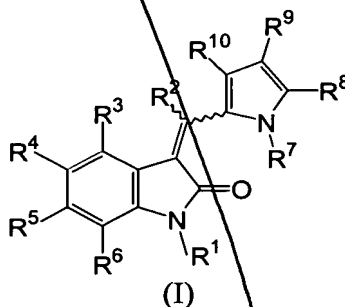


CLAIMS

What is claimed is:

5 1. A formulation suitable for parenteral or oral administration, said formulation comprising an ionizable substituted indolinone, and a pharmaceutically acceptable carrier therefor, wherein said ionizable substituted indolinone comprises at least one or more hydrocarbon chains substituted with at least one polar group.

10 2. The formulation of claim 1, wherein said pharmaceutically acceptable carrier is selected from the group consisting of one or more polyoxyhydrocarbyl compounds, one or more buffers, one or more pharmaceutically acceptable surfactants, one or more pharmaceutically acceptable preservatives, one or more antioxidants, one or more pharmaceutically acceptable alcohols, one or more pharmaceutically acceptable aqueous solutions, one or more pharmaceutically acceptable oils, liposomes, one or more polyglycolized lipids, one or more pharmaceutically acceptable granulating agents, one or more pharmaceutically acceptable diluents, one or more pharmaceutically acceptable binders, one or more pharmaceutically acceptable disintegrants, one or more pharmaceutically acceptable lubricants, one or more pharmaceutically acceptable flow enhancers, one or more pharmaceutically acceptable suspending agents, and combinations thereof, and
15 wherein said ionizable substituted indolinone is a compound having the following chemical structure:
20



wherein

R¹ is selected from the group consisting of hydrogen, alkyl, alkenyl, alkynyl, cycloalkyl, aryl, hydroxy, alkoxy, C-carboxy, O-carboxy, acetyl, C-amido, C-thioamido, sulfonyl and trihalomethanesulfonyl;

5 R² is selected from the group consisting of hydrogen, halo, alkyl, cycloalkyl, aryl, heteroaryl and heteroalicyclic;

10 R³, R⁴, R⁵ and R⁶ are independently selected from the group consisting of hydrogen, alkyl, trihaloalkyl, cycloalkyl, alkenyl, alkynyl, aryl, heteroaryl, heteroalicyclic, hydroxy, alkoxy, aryloxy, mercapto, alkylthio, arylthio, sulfinyl, sulfonyl, S-sulfonamido, N-sulfonamido, trihalomethane-sulfonamido, carbonyl, C-carboxy, O-carboxy, C-amido, N-amido, cyano, nitro, halo, O-carbamyl, N-carbamyl, O-thiocarbamyl, N-thiocarbamyl, amino and -NR¹¹R¹²;

15 R¹¹ and R¹² are independently selected from the group consisting of hydrogen, alkyl, cycloalkyl, aryl, heteroaryl, carbonyl, acetyl, sulfonyl, trifluoromethanesulfonyl and, combined, a five- or six-member heteroalicyclic ring;

20 R³ and R⁴, R⁴ and R⁵, or R⁵ and R⁶ may combine to form a six-member aryl ring, a methylenedioxy group or an ethylenedioxy group;

25 R⁷ is selected from the group consisting of hydrogen, alkyl, cycloalkyl, alkenyl, alkynyl, aryl, heteroaryl, heteroalicyclic, hydroxy, alkoxy, aryloxy, carbonyl, acetyl, C-amido, C-thioamido, amidino, C-carboxy, O-carboxy, sulfonyl and trihalomethane-sulfonyl;

30 R⁸, R⁹ and R¹⁰ are independently selected from the group consisting of hydrogen, alkyl, trihaloalkyl, cycloalkyl, alkenyl, alkynyl, aryl, heteroaryl, heteroalicyclic, hydroxy, alkoxy, aryloxy, mercapto, alkylthio, arylthio, sulfinyl, sulfonyl, S-sulfonamido, N-sulfonamido, carbonyl, C-carboxy, O-carboxy, cyano, nitro, halo, O-carbamyl, N-carbamyl, O-thiocarbamyl, N-thiocarbamyl, C-amido, N-amido, amino and -NR¹¹R¹², providing, however that at least one of R⁸, R⁹ or R¹⁰ is a group having the formula -(alk₁)Z, wherein

Alk₁ is selected from the group consisting of alkyl, alkenyl or alkynyl, and Z is a polar group

35 or R⁸ and R⁹ or R⁹ and R¹⁰ may combine to form a six-membered alicyclic ring.

AR ~~SC6~~ 3. The formulation of claim 2, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

5 4. The formulation of claim 2, wherein said formulation is suitable for parenteral administration.

10 5. The formulation of claim 4, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

6. The formulation of claim 4, wherein said pharmaceutically acceptable carrier comprises one or more polyoxyhydrocarbyl compounds.

AR ~~SC6~~ 7. The formulation of claim 6, wherein each of said one or more polyoxyhydrocarbyl compounds is independently selected from the group consisting of water soluble carbohydrates, water soluble carbohydrate derivatives, water soluble polypeptides, water soluble polymers, water soluble mixed oxyalkylene polymers, the polymeric forms of ethylene glycol, and combinations thereof.

20 8. The formulation of claim 6, wherein each of said one or more polyoxyhydrocarbyl compounds is independently selected from the group consisting of polyethylene glycol 300, polyethylene glycol 400, propyleneglycol, glycerin, and combinations thereof.

9. The formulation of claim 4, wherein said ionizable substituted indolinone is solubilized by combining with a molar equivalent of a base solution or an acid solution.

25 AR ~~SC6~~ 10. The formulation of claim 9, wherein said base solution is selected from the group consisting of sodium hydroxide, ammonium hydroxide,

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Cont

triethylamine, ethylenediamine, N-methyl-D-glucamine, choline, and triethanolamine.

11. The formulation of claim 9, wherein said acid solution is selected from the group consisting of hydrochloric acid, sulfuric acid, formic acid, lactic acid, malic acid, succinic acid, acetic acid, methane sulfonic acid, benzene sulfonic acid, and phosphoric acid.

12. The formulation of claim 6, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

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SUB

13. The formulation of claim 6, wherein said pharmaceutically acceptable carrier further comprises one or more buffers.

14. The formulation of claim 13, wherein each of said one or more buffers is independently selected from the group consisting of acetate, citrate, phosphoric acid buffer, ascorbate, hydrochloric acid buffer, Tris-HCl buffer, sodium phosphate, sodium carbonate, sodium hydroxide, glutamate, glycine, and Tris base buffers.

15. The formulation of claim 13, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

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SUB

16. The formulation of claim 6, wherein said pharmaceutically acceptable carrier further comprises one or more pharmaceutically acceptable surfactants.

17. The formulation of claim 16, wherein each of said one or more pharmaceutically acceptable surfactants is independently selected from the group consisting of pharmaceutically acceptable non-ionic surfactants and pharmaceutically acceptable anionic surfactants.

18. The formulation of claim 16, wherein each of said one or more pharmaceutically acceptable surfactants is a non-ionic surfactant independently selected from the group consisting of polyoxyethylenepolypropylene glycols, polyoxyethylene castor oil derivatives, polyoxyethyleneglycerol oxystearate.

5 19. The formulation of claim 16, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

10 ~~A 7 5/6~~ 20. The formulation of claim 6, wherein said pharmaceutically acceptable carrier further comprises one or more pharmaceutically acceptable preservatives.

21. The formulation of claim 20, wherein each of said one or more pharmaceutically acceptable preservatives is independently selected from the group consisting of benzyl alcohol, methyl paraben, ethyl paraben, and phenol.

15 22. The formulation of claim 20, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

~~A 8 5/6~~ 23. The formulation of claim 6, wherein said pharmaceutically acceptable carrier further comprises one or more antioxidants.

20 24. The formulation of claim 23, wherein each of said one or more antioxidants is independently selected from the group consisting of sodium metabisulfite, EDTA, ascorbic acid, and benzyl alcohol.

25 25. The formulation of claim 23, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

26. The formulation of claim 6, wherein said pharmaceutically acceptable carrier further comprises one or more pharmaceutically acceptable alcohols.

27. The formulation of claim 26, wherein each of said one or more pharmaceutically acceptable alcohols is independently selected from the group consisting of ethanol, benzyl alcohol, propylene glycol, 2-(2-ethoxyethoxy)ethanol, and glycerol.

28. The formulation of claim 26, wherein said pharmaceutically acceptable carrier further comprises an amount of pharmaceutically acceptable aqueous solution effective to prevent hemolysis on parenteral administration to a patient in need thereof.

29. The formulation of claim 26, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

30. The formulation of claim 6, wherein said pharmaceutically acceptable carrier further comprises one or more pharmaceutically acceptable oils.

31. The formulation of claim 30, wherein each of said one or more pharmaceutically acceptable oils is independently selected from the group consisting of mineral oils, vegetable oils, fractionated coconut oils, sesame oil, propyleneglycol monolaurate, and mixed triglycerides with caprylic acid and capric acid.

32. The formulation of claim 30, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

33. The formulation of claim 2, wherein said formulation is suitable for oral administration.

34. The formulation of claim 33, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

5 35. The formulation of claim 33, wherein said pharmaceutically acceptable carrier comprises one or more polyoxyhydrocarbyl compounds.

36. The formulation of claim 35, wherein each of said one or more polyoxyhydrocarbyl compounds is independently selected from the group consisting of water soluble carbohydrates, water soluble carbohydrate derivatives, water soluble polypeptides, water soluble polymers, water soluble mixed oxyalkylene polymers, and the polymeric forms of ethylene glycol.

37. The formulation of claim 35, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

38. The formulation of claim 33, wherein said pharmaceutically acceptable carrier comprises one or more polyglycolized lipids.

39. The formulation of claim 38, wherein each of said one or more polyglycolized lipids is independently selected from the group consisting of monoglycerides, diglycerides, triglycerides, polyethyleneglycol monoesters, and polyethyleneglycol diesters.

40. The formulation of claim 38, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

41. The formulation of claim 33, wherein said pharmaceutically acceptable carrier comprises one or more pharmaceutically acceptable surfactants.

42. The formulation of claim 41, wherein each of said one or more pharmaceutically acceptable surfactants is independently selected from the group consisting of non-ionic surfactants and pharmaceutically acceptable anionic surfactants.

5 43. The formulation of claim 41, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

10 44. The formulation of claim 33, wherein said pharmaceutically acceptable carrier comprises one or more pharmaceutically acceptable granulating agents.

15 45. The formulation of claim 44, wherein each of said pharmaceutically acceptable granulating agents is selected from the group consisting of silicon dioxide, microcrystalline cellulose, starch, calcium carbonate, pectin, crospovidone, water, alcohol and polyplasdone or a combination of any of the proceeding.

46. The formulation of claim 44, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

20 47. The formulation of claim 33, wherein said pharmaceutically acceptable carrier comprises two or more of the members of the group consisting of one or more polyoxyhydrocarbyl compounds, one or more polyglycolized lipids, one or more surfactants, and one or more granulating agents.

25 48. The formulation of claim 47, wherein said pharmaceutically acceptable carrier comprises one or more polyoxyhydrocarbyl compounds, one or more polyglycolized lipids, and one or more surfactants.

49. A pharmaceutically acceptable composition selected from the group consisting of a hard gelatin capsule whose filling comprises the formulation of claim 33, a soft gelatin capsule whose filling comprises the formulation of claim 33, and a hard gelatin capsule whose filling comprises the formulation of claim 44.

50. The formulation of claim 33, wherein said formulation is solid, and wherein said pharmaceutically acceptable carriers comprise one or more pharmaceutically acceptable diluents, one or more pharmaceutically acceptable binders, one or more pharmaceutically acceptable disintegrants, one or more pharmaceutically acceptable surfactants, one or more pharmaceutically acceptable lubricants, and one or more pharmaceutically acceptable flow enhancers.

51. The formulation of claim 50, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

52. The formulation of claim 50, wherein each of said one or more pharmaceutically acceptable diluents is selected from the group consisting of pregelatinized starch, lactose monohydrate, lactose, monohydrate regular grade, mannitol, calcium phosphate and microcrystalline cellulose.

53. The formulation of claim 50, wherein each of said one or more pharmaceutically acceptable binders is selected from the group consisting of polyvinylpyrrolidone, hydroxypropylmethyl cellulose, hydroxypropylcellulose and starch.

54. The formulation of claim 50, wherein each of said one or more pharmaceutically acceptable disintegrants is selected from the group consisting of crosscarmellose sodium, sodium starch glycolate, gspovidone, and starch.

55. The formulation of claim 50, wherein each of said one or more pharmaceutically acceptable surfactants is selected from the group consisting of sodium lauryl sulfate, polysorbate and cetylpyridinium chloride.

56. The formulation of claim 50, wherein each of said one or more pharmaceutically acceptable lubricants is selected from the group consisting of magnesium stearate, sodium stearyl fumarate, glyceryl behenate and stearic acid.

57. The formulation of claim 50, wherein each of said one or more pharmaceutically acceptable flow enhancers is selected from the group consisting of colloidal silicon dioxide and talc.

58. The formulation of claim 33, wherein said formulation is a solution, and wherein said pharmaceutically acceptable carrier comprises one or more polyoxyhydrocarbyl compounds, one or more surfactants, and one or more buffers.

59. The formulation of claim 58, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

60. The formulation of claim 58, wherein said polyoxyhydrocarbyl compound is selected from the group consisting of water soluble carbohydrates, water soluble carbohydrate derivatives, water soluble polypeptides, water soluble polymers, water soluble mixed oxyalkylene polymers, the polymeric forms of ethylene glycol, and combinations thereof.

61. The formulation of claim 58, wherein said surfactant is selected from the group consisting of pharmaceutically acceptable non-ionic surfactants and pharmaceutically acceptable anionic surfactants.

62. The formulation of claim 58, wherein said buffer is selected from the group consisting of acetate, citrate, phosphoric acid buffer, ascorbate, hydrochloric

acid buffer, Tris-HCl buffer, sodium phosphate, sodium carbonate, sodium hydroxide, glutamate, glycine, and Tris base buffers.

63. The formulation of claim 33, wherein said formulation is an aqueous suspension, and wherein said pharmaceutically acceptable carrier comprises a suspending agent and a surfactant.

64. The formulation of claim 63, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

65. The formulation of claim 63, wherein said suspending agent is selected from the group consisting of carboxymethylcellulose, hydroxypropylmethylcellulose, povidone and starch.

66. The formulation of claim 63, wherein said surfactant is selected from the group consisting of pharmaceutically acceptable non-ionic surfactants and pharmaceutically acceptable anionic surfactants.

67. The formulation of claim 33, wherein said pharmaceutically acceptable carrier comprises one or more pharmaceutically acceptable surfactants and one or more pharmaceutically acceptable oils.

68. The formulation of claim 67, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid or an analog thereof.

69. The formulation of claim 68, wherein said pharmaceutically acceptable surfactant comprises an ethylene oxide copolymer and said pharmaceutically acceptable oil comprises sesame oil.

70. The formulation of claim 69, wherein said ionizable substituted indolinone is present in a concentration selected from the range of about 50 mg/gm to about 750 mg/gm.

71. The formulation of claim 69, wherein said ionizable substituted indolinone is present in a concentration selected from the range of about 50 mg/gm to about 500 mg/gm.

72. The formulation of claim 69, wherein said ionizable substituted indolinone is present in a concentration selected from the range of about 50 mg/gm to about 200 mg/gm.

73. A method of preparing a formulation comprising adding to a salt solution, formed in situ by admixing a molar equivalent of a base solution or an acid solution with an ionizable substituted indolinone, one or more polyoxyhydrocarbyl compounds and/or one or more buffers.

74. The method of claim 73, wherein both said one or more polyoxyhydrocarbyl compounds and said one or more buffers are added to said salt solution.

75. The method of claim 73, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

5/13 76. A method of making a formulation suitable for oral administration comprising admixing an ionizable substituted indolinone, one or more pharmaceutically acceptable surfactants, and one or more pharmaceutically acceptable oils.

77. The method of claim 76, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-

pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

78. A method of preventing or treating a protein kinase related disorder in a patient in need of treatment comprising:

5 a. diluting a parenteral formulation into a pharmaceutically acceptable solution, said parenteral formulation comprising an ionizable substituted indolinone, one or more polyoxyhydrocarbyl compounds, and a buffer;

b. parenterally administering said diluted formulation to said patient.

79. The method of claim 78, wherein said ionizable substituted
10 indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

80. A method of preventing or treating a protein kinase related disorder in a patient in need of treatment comprising orally administering to said patient a
15 formulation comprising an ionizable substituted indolinone, one or more pharmaceutically acceptable surfactants, and one or more pharmaceutically acceptable oils.

81. The method of claim 80, wherein said ionizable substituted indolinone is 3-[2,4-dimethyl-5-(2-oxo-1,2-dihydro-indol-3-ylidenemethyl)-1H-
20 pyrrol-3-yl]-propionic acid, or a pharmaceutically acceptable salt, prodrug, derivative, or analog thereof.

82. The method of claim 81, wherein said ionizable substituted indolinone is present in a concentration in the range from about 50 mg/gm to about 750 mg/gm.

83. The method of claim 81, wherein said ionizable substituted indolinone is present in a concentration in the range from about 50 mg/gm to about 500 mg/gm.

84. The method of claim 81, wherein said ionizable substituted
5 indolinone is present in a concentration in the range from about 50 mg/gm to about 250 mg/gm.

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